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ABSTRACT

As more academic institutions spend larger sums of money to network their campuses and provide network connections to sources outside their campuses, questions emerge concerning the selection and configuration of appropriate network technologies and the appropriate types and levels of services to provide. Increasingly, academic administrators are asking questions about the benefits and impacts of networking. This paper reports on a study to develop and operationalize performance measures and indicators of the impacts of networking on the academic institution. The study examines information resources and services provided, organizational structures within which they are provided, the various classes of users, and users' activities on the network. Measurement and evaluation of networked information services is essential for administrators to justify such services and better meet user information needs. Approaches for evaluating networked information services are based on: (1) extensiveness--how much of the service has been provided; (2) efficiency--the use of resources in providing or accessing networked information services; (3) effectiveness--how well the networked information service met the objectives of the provider or user; and (4) impact--how a service made a difference in some other activity or situation. Performance measures and evaluation; key issues; attitudes, problems, and perceptions; possible performance measures; study progress; and the importance of the project are described. A brief discussion with the author is provided. (Contains 16 references.) (Author/SWC)

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Performance Measures for the Academic Networked Environment

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Performance Measures for the Academic Networked Environment [Notes 1, 2]

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Abstract

As more academic institutions spend larger sums of money to network their campuses and provide network connections to sources outside their campuses, questions concerning the selection and configuration of appropriate network technologies, and the appropriate types and levels of services to provide, are emerging. Increasingly, academic administrators are asking questions about the benefits and impacts of networking.

This paper reports on a study in progress designed to address these, and other questions related to assessing network technologies and services at academic institutions. The purpose of this study is to develop performance measures and indicators of the impacts of networking on the academic institution. Key components of the academic networked environment will be defined and performance measures of networked information technologies and services at academic institutions will be developed and operationalized.

The paper provides an overview of the study's progress to date, identifies and discusses key issues and preliminary findings that affect successful evaluation of networked services and the development of performance measures, and describes an academic networked environment performance measures manual that is currently under development.

Introduction

The notion of the 'academic networked environment' encompasses a range of campus electronic networked activities and services. Minimally, the academic networked environment includes information services, products, hardware and software, and resources which are received by campus users via electronic networks. In this environment, information services are provided by regional and national networks, although locally developed information services (ie. from the library, computing services, administration, individuals, or academic departments) also comprise the academic networked environment. Both the networking of users and resources within the institution as well the connecting of these users to other persons and resources outside of the institution are considered part of this environment.

The notion of networked information services is an evolving one. Such services can be offered by individuals, libraries, computer centers, publishers, networks, government agencies, or a host of other organizations and groups with access to the Internet and the evolving National Information Infrastructure (NII) (Huth and Gould, 1994) and the Global Information Infrastructure (GII) (Gore, 1995). Networked information services comprise bulletin boards; email; list-servs; remote access to distant databases, software, and high speed computing; and collaborative efforts among geographically dispersed individuals - to name but a few. A key aspect of 'networked information services' is that there are numerous providers - local and remote; there are a range of electronic information services available to users; and access to and use of these services continues to increase.

Despite the fact that many institutions of higher education have built significant networks and are connected to the Internet and the evolving GII and NII, there is little knowledge of how such connectivity has affected the academic institution. Thus, some key questions are:

- How much networking activity and of what types are taking place on a particular academic campus?
- What types of users access the academic net work and to what types of services and activities do they connect?
- What are the costs for an academic network and various types of network activities and services?
- How has access to and use of networked information resources and services affected teaching, research, learning, service, and other indicators of traditional academic performance?

To date, there has been little practical guidance offered to assess the impact of networking on these traditional areas of academic institutional performance. Moreover, performance measures related to network use by specific audiences within the institution such as faculty, administrators, librarians, students, and staff, are only now being developed.

As nonprofit organizations implement new information technologies, they are beginning to call for evaluation methods and measures to demonstrate that the resources invested in the new technologies have had some positive impact on their organizations, the services they provide, and the users they serve. Traditional economic models that evaluate the impacts of information technology in terms of an organization's bottom line are neither appropriate for nonprofit, service organizations, nor have they been used with much success in for-profit organizations (Brynjolfsson, 1993; Computer Science and Telecommunications Board, 1994).

There is evidence that a restructuring of the computing and communications infrastructure as a result of the availability and use of electronic information is occurring and that this will have a fundamental impact on educational institutions. Already, this restructuring is affecting the communication customs and expectations of researchers in a variety of fields. In a larger sense, this restructuring is affecting the entire information transfer cycle from the creation, structuring, and representation of information to its dissemination and use by the members of academic communities (McClure, 1993).

A number of writers have attempted to describe the evolving academic networked environment and consider possible problems facing its development (Lynch, 1991; Drake, 1993). Recent reports issued by the Corporation for Public Broadcasting (1994) and the American Council on Education (1995) summarize current developments on uses and applications of information and networking technologies on campuses in the USA. But, to date, few formal efforts have been made to develop techniques to produce performance measures and assess the impact of networked information services on such an environment.

Traditional criteria used in assessing information services may serve as a beginning model for networked information services assessment. For example, traditional performance indicators typically examine a service, activity, or product in terms of: extensiveness, effectiveness, efficiency, and impact (McClure, 1991). In addition, CAUSE, an association for managing and using information resources in higher education, published an excellent tool, *Self-assessment for campus information technology services* (Fleit, 1994) as well as *Evaluation guidelines for institutional information resources* (CAUSE, 1995). Those in the process of assessing the academic networked environment may wish to review the self-assessment technique and the guidelines developed by CAUSE.

As described above, this is an exploratory study in progress and as such it is based on two broad research questions:

- What is the academic networked environment?
- What performance measures can be developed and tested to assess this academic networked environment?

In answering the first question, the study examines information resources and services provided, organizational structures within which they are provided, the various classes of users involved, and users' activities on the network. To answer the second question the study reviewed existing measures used at individual institutions and is developing and testing new measures of academic networking effectiveness, efficiency, and extensiveness, as well as impact. A core set of possible performance measures as well as other evaluation techniques will be developed in a manual to assist those engaged in assessing academic networked environments.

Because of the exploratory nature of this investigation, an inductive approach, using a variety of qualitative methods, is being taken. Among the methods being used are: focus groups, case studies, site visits, and interviews. Individuals involved in the design, implementation, support, and use of networked resources and services provide on-going feedback and comments on the study via an electronic discussion list (see Appendix A). Individuals interested in learning more about the project and receiving updated project information are welcome to join the list.

Performance Measures and Evaluation

Performance measures represent a broad managerial/evaluation concept that encompasses measurement of inputs (indicators of the resources essential to provide a service), outputs (indicators of the services resulting from the use of those resources), and impacts (the effect of these outcomes on other variables or factors). They are an essential means to assess the academic networked environment. Performance measures serve a number of useful purposes. They can:

- Identify those aspects of the network that are successful versus those aspects that are less successful
- Provide trend-data to assess changes in the network and network services over time
- Assist decision makers to allocate or reallocate resources and to plan for future network development
- Monitor network activities and services to inform managers of any changes in activities or the quality of services
- Determine the degree to which users are satisfied with the network and network services
- Assist network managers to justify expenditures and be accountable for those expenditures

Simply stated, performance measures ask decision-makers to answer the question: How well is the service or activity doing what it claims to be doing?

Performance measures also assist managers to formally evaluate the network. Thus, evaluation is the process of identifying and collecting data about specific services or activities, establishing criteria to assess their success, and determining the degree to which the service or activity accomplishes stated objectives. As such, evaluation is a decision-making tool intended primarily to assist decision-makers allocate resources that best accomplish organizational goals. Evaluation reflects value judgements on the part of the evaluator regarding the adequacy, appropriateness, and success of a particular service or activity.

In a broader organizational context, measurement and evaluation of networked information services are essential for resource allocation, planning, and improving services. Without measures that can evaluate particular services, decision-makers must rely on intuition and anecdotal information as a basis for assessing the usefulness and value of a particular service. Perhaps most importantly, measurement and evaluation provide feedback for users to make known how well those services meet their needs.

Approaches for evaluating networked information services can be based on the following criteria:

- Extensiveness: how much of the service has been provided, eg. number of users logging-in per week on a bulletin board, or the number of participants of a particular list-serv
- Efficiency: the use of resources in providing or accessing networked information services, eg. cost per session in providing access to remote users of an online catalog, or average time required to successfully telnet to a remote database
- Effectiveness: how well the networked information service met the objectives of the provider or of the user, eg. success rate of identifying and accessing the information needed by the user
- Impact: how a service made a difference in some other activity or situation, eg. the degree to which faculty network users increased their research productivity or teaching effectiveness by use of networked information services

Although evaluations of networked information services need to consider extensiveness and efficiency criteria, much more attention needs to be given to effectiveness and impact measures. As will be discussed later in this paper, however, developing measures of impacts from networked services remains a very difficult task.

Because networked information services are multi-dimensional, the type of evaluation needed typically will be multi-dimensional. A single measure provides only one 'snapshot' of a particular service; multiple 'snapshots' from different measures are needed. Moreover, evaluators of networked information services will need to know what type of evaluation approach and data collection techniques will be appropriate for what types of services (McClure, 1994). An important point, however, is that researchers need to develop evaluation strategies that are user-based, that is, they examine networked information services from the point-of-view of the user.

Providers of networked information services must not accept as a 'given' that their services, resources, and technical procedures are efficient and effective; rather, they must test their assumptions about the quality of networked information services through an ongoing process of evaluation. Ongoing evaluation activities are essential to support the provider's planning process. Planning and evaluation are two sides of the same coin. Each will be more successful when the other is part of the overall services design and implementation approach.

Developing, operationalizing, and validating a range of performance measures that encourages an academic institution to assess what types of networked information services have what level of quality, have what impacts on the educational process, and have what costs is essential if administrators of networked information in the academic setting are to justify such services and better meet user information needs.

Selected Key Issues

At this writing, a number of site visits, focus groups, and small group interviews have been conducted at professional conferences and in selected academic institutions. Participants were academic computing professionals, librarians, and others from a variety of institutions. The primary intent in conducting data collection activities was to inform the study team's understanding of the research questions, the state of modeling and evaluation of academic networking in practice, and to obtain assessments of draft performance measures under development by the study team. The key issues which emerged from data collection activities to date include the following.

DRIVERS OF THE DEVELOPMENT OF NETWORK TECHNOLOGIES AND SERVICES

Participants identified changes in users' expectations and experiences, changes in technology, and changes in the nature of educational processes, and institutional support for those processes, as drivers of the development of networking on their campuses.

Both faculty and students now seem to expect that network access should, and will, be available at all times, and from a variety of locations. Such expectations have been instrumental in causing network providers to accelerate their planning and implementation schedules. This has been particularly true in the case of incoming freshmen. One academic administrator commented:

> 'Seeing a whole new crop of freshmen come in, computer literate in a way that we had never seen before . . . all of a sudden this class came in and said, "This is our god given right and why isn't there a connection in every dorm room?" We had a plan to have that in a year and a half, and we . . . have just spent the last two months wildly coming up with a plan to make sure that we got it by September, 1995, because student demand is there.'

In addition, there is a recognition among university administrators that a network is essential in order to attract faculty. As one participant explained, quoting a university provost, 'The world is now very different and every faculty person we recruit needs a dowry, needs to understand what kind of workstation they are going to have on their desk, what kind of networking connection.'

BARRIERS TO THE DEVELOPMENT OF NETWORK TECHNOLOGIES AND SERVICES

In spite of the increasing demand for networking and growing recognition on the part of administrators of the importance of networking, a number of barriers to the growth and development of networking exist. Among these are problems associated with network technologies and pedagogical limitations.

A major challenge to network managers is ' . . . getting our systems to be easy to use. They're still not good enough. They're not like dialing a telephone to get what you need . . . the systems are not intuitive and easy to use. And there are a trillion different kinds of systems and almost a trillion different interfaces to access them . . . .'

Another aspect of the network technology which stands in the way of development is its distributed nature and the problems that creates. 'Anyone can get an Internet address and hang a server on the network. There are a whole lot of issues that the mainframe administrator used to handle. It's now distributed all over the network. And if they don't manage it properly . . . your whole network is exposed.' This distributed environment presents an image, oftentimes, that no one is really in charge or in control of networking developments on campus - these developments just 'happen'.

Yet another barrier to the development of networking is the lack of appropriate pedagogical models to take advantage of the technology. 'People are fundamentally automating old things . . . most of our professors haven't really internalized how to use the technology to really change the way they conduct their classes.' The full advantage of networking may not be realized until new pedagogical models are developed. By this, the authors mean that it may be too early to measure impacts of networking on the academic institution since traditional models of teaching and learning are still in use. New models for teaching and learning that exploit the networked environment are still being developed. As one interviewee commented, 'We are all still floundering a bit as to how best to use and apply networking services.'

A final issue which was identified during the data collection was that of measures of the impacts of networking. Participants discussed financial measures and impact measures and agreed that, while traditional measures of technology impacts are often inappropriate, new measures are yet to be developed. 'All of the traditional models, all of the accounting models, just don't apply any more . . .

[we need] to develop new models, and these models are going to be squishier.'

There was also some suggestion that academic administrators don't ask for economic justification of requests for investment in new technologies, or in other improvements to the institution. 'Colleges and universities don't make these decisions based on direct economic issues. They don't ask what is the cost benefit . . . they don't ask that with respect to anything they do. I mean there is no bottom line, there isn't.'

THE NEED FOR MEASURES AND ASSESSMENT

Moving beyond financial measures, participants discussed a developing interest in measures of the impacts of networking on teaching and learning. Administrators are beginning to ask questions like, 'Has it enabled an instructor to increase the contents or broaden the contents or get deeper in the content of the class?' and 'Has it reduced their administrative work in administering the class?'

In response to such questions, network administrators are beginning to develop and apply new measures. For example, 'We provided multimedia support for classrooms where we have evidence that the faculty member is spending less time on the mechanics and more on the content. So that the students are getting more content and learning it faster.' However, most evidence of networking's impacts on teaching and learning is anecdotal.

For example, one faculty member commented, 'We've got an architecture class, and we're doing shared design projects with students in Norway.' Another faculty member stated 'I have a small class and there's another fellow in Nebraska with a small class, and we are collaborating using the Internet. There are all kinds of things like that that you can point to that you can say that those are things that could not have happened any other way. So those are tangible outcomes but you can't measure them.'

Another problem identified in trying to create measures of the impacts of networking on activities like teaching and learning is the lack of good measures of these activities, regardless of networking, and the lack of existing data on teaching and learning in a non-networked environment at some institutions. 'We never really measured these outcome measures or evaluated the quality of instruction or learning or anything anyway. So now we are asking how has this proved something that we never measured anyway.'

Although there are examples of the impacts of networking, as described above, measurement of these impacts remains very difficult. 'We are at a very immature stage where we really, I think, are only getting glimpses of what the future is going to hold. And so, it's going to be very hard, I'd say, to measure things, because it's very foggy just where all this is going to go.' This difficulty in identifying and measuring 'impacts' from networking is the result of an exceedingly complex distributed networking environment, a rapidly changing networking infrastructure, and the lack of conceptual tools to describe this environment.

Attitudes, Problems, and Perceptions

Based on the various site visits and other data collection activities, a number of similar views and attitudes toward evaluation and the development of performance measures is evolving. Understanding these attitudes and the 'evaluation culture' at an academic institution is important as they will affect the degree to which successful ongoing evaluation and use of performance measures can be implemented.

EVALUATION OF NETWORK ACTIVITIES AND SERVICES IS A 'GOOD THING' BUT RARELY DONE

In general, participants agreed with this view. But they also agreed that none of them conducts evaluations regularly. There was an underlying assumption that the network is a good thing and that the need for it is essential and growing. Therefore evaluations to determine what's wrong with the network or whether the network is necessary are not needed. 'It's not like I'm going to come out with an earth-shattering study that's going to prove technology is worthless and we're all going to go back to books. It's not going to happen.'

INEQUALITIES OF COMPUTING RESOURCES

A network administrator described his university as a 'very, very heterogeneous environment. Some college units are relatively resource rich some are relatively resource poor and it's got more to do with the historical situation than with anything that's evolved because of the structural needs of the information technology. Addressing that imbalance is going to be one of the immediate items on the agenda over the next few years, addressing it in some formal, systematic way . . . and addressing where the line is between central and distributed support.' He recognized that having some type of performance measures could assist them to deal with this issue, and over time, determine the degree to which 'progress' in equalizing resources had been made.

NON-SYSTEMATIC COLLECTION OF NETWORKING DATA

There was evidence that some data on network performance are being collected, by different units within the institution and by different people, but there is little evidence that the data are being collected and analyzed in a systematic way or that they are being used in planning and decision-making related to networking development. Interviewees agreed that having a central MIS that identified, collected, organized, analyzed, and reported selected networking statistics would be an important step forward and was essential to be able to better plan for networking services. They also noted a range of problems and issues that would have to be resolved if such an MIS were to be established at this particular institution.

REACHING AGREEMENT OF NETWORKING TERMS AND EVALUATION PROCEDURES

Some interesting discussions occurred regarding the use of different procedures and different terms for the evaluation that had been done at some of these sites. There was little confidence that central computing services could obtain agreement from other stakeholders on campus as to the appropriate definitions to be used in a larger institutional effort on evaluation. One person commented, 'it would take an act of God to reach such agreement.' Yet, it was recognized that until campus-wide agreement on how best to define key terms occurred, development of performance measures would be impossible.

BARRIERS TO ONGOING NETWORKING EVALUATION

Participants offered a number of reasons for the lack of systematic data collection and low priority placed on evaluation activities.

- Some interviewees were suspicious of the goals of evaluation. When asked what his response would be if his director asked for this type of data, one person said, 'My first question would be, "What are you going to do with it?"' The fear of how evaluation results might be used prompted some to not want to know how well or poorly a service was provided.

- There are 'power pockets' throughout the university and a grossly unequal distribution of resources. Thus some groups have a vested interest in not sharing information about the extent of their resources lest they be pressured to share those resources.

- Individuals charged with providing network access to a growing, and an increasingly demanding, group of users may not have the time and resources to conduct evaluations. Their focus is on keeping the network running and meeting users' demands for speed and power. As one administrator described it, 'Life is very simple for me as a network planner. I need to keep figuring out how to get the best, biggest, fastest, cheapest pipe in here possible on the presumption that the need for bandwidth is going to get bigger and bigger and bigger . . .'.

- The lack of support (in the form of additional resources, a GA to do data collection, etc.) to conduct such evaluations and for some, limited knowledge on how to conduct such evaluations is also a barrier. Evaluation is 'just another thing to do' in addition to a range of other responsibilities and no additional institutional support seems to be provided for such evaluation. One person indicated that before he would feel 'comfortable' doing such evaluation, additional training would be needed.

- The lack of incentives to conduct such evaluations. While generally agreeing that evaluation was a good thing, they also noted that there were few tangible and direct incentives for conducting such evaluations. As one person commented, there was not an institutional mindset supporting ongoing evaluations.

- A lack of faith in the utility and applicability of evaluation results. There is an underlying sense in many academic institutions that ongoing evaluation of services and activities does not produce useful results or offer specific recommendations for how to improve networked information services. Further, there is oftentimes no tradition or culture of ongoing evaluation in the campus setting.

- The oftentimes confusing distribution of technologies and services, and responsibilities for managing those technologies and services, compound the problems associated with evaluation. It is not always clear who is responsible for what. A number of the participants commented that they were unsure who did what in terms of networking or were unsure who should be contacted to solve a particular networking problem.

Similarly, when a university provides network access to information services and resources produced by others - such as access to remote databases - it is unclear what exactly is being

evaluated, services and resources provided by the university or by the remote site or by the network providers?

- There are considerable difficulties in defining key networking terms and services in such a way that they can be operationalized for measurement. Thus, before evaluation can occur, the institution may first have to reach agreement on how to operationalize key networking activities for measurement and clarify policies related to networked information services.
- The recent rapid growth and change in networking makes evaluation and planning extremely difficult. It is not always possible to predict the next direction in the technology. I remember when someone said, 'Who needs a laserwriter? What are you going to do with that?' And desktop publishing. Nobody could have predicted this stuff. About the time staff get 'geared up' to evaluate a particular service, it is no longer provided or it is out-of-date.
- Networking infrastructures, services, and administrative organization for networking change rapidly. Evaluation is difficult in such a volatile environment. For example, on the day that the study team conducted interviews at one site visit, the Vice President for Computing announced a re-organization of the management responsibilities for computing services on campus.

In summary, interviewees agreed they would evaluate network performance if: someone 'ordered them to do so'; they believed that the results would bring them additional resources; they could expect to receive additional personnel to conduct evaluations; they had training in evaluation methods; and if they had the time to conduct evaluations. As one interviewee said, 'in an ideal world yes, we would have ongoing evaluation; but the reality is we can't and don't.'

Possible Performance Measures

The procedures and measures being developed for the manual are based on a research effort that obtained information, assessments, and input from a number of site visits and individuals knowledgeable about academic computing and networking. A key finding from this work is the limited knowledge and use of performance measures in the academic environment. The complexity of the academic networked environment imposes some limitations on the degree to which measures of this environment can be developed.

Although the manual describes standardized procedures for data collection and computing performance measures, the resulting measures are unlikely to be comparable across different institutions of higher education. The networking infrastructure and the manner in which data are available in different institutions vary considerably. Furthermore, different institutions may use different definitions for key terms. While these concerns will not hinder the use of these measures in one particular institution, they will limit the degree to which measures can be compared to results at other institutions.

To some degree, users of the manual may have to develop policies and define data collection activities within a range of organizational and network constraints. Indeed, some institutions may not currently have the capacity to collect the data needed for some of these performance measures. In such instances, the academic institution will need to first determine how best the data can be collected, develop a system or approach for collecting and analyzing that data, and develop policies that formalize a management information system to insure that the data continues to be collected in a regular and standardized fashion.

The research project revealed a number of different views and experiences regarding which types of performance measures might be most useful given an institution's particular situation. Thus, the approach taken in the manual is to identify and describe a core set of measures. Depending on the nature of the network, the administrative concerns regarding that network, and networking/institutional goals and objectives, some of the following measures may be more useful for some institutions than others.

The scores that result from these performance measures take on greater usefulness when considered in the broader context of:

- Institutional and networking goals and objectives at that particular institution
- Other performance measures of institutional activities, services, and participants
- Various time periods and the amount of change on this particular measure over time
- The amount of resources and the allocation of those resources for networking infrastructure and services
- Factors related to a particular institution, its networking configuration, or other variables unique to that institution.

In short, value judgements as to whether a score on a performance measure is 'good' or 'bad' are dependent on a range of other factors and should not be considered in isolation of those factors.

Finally, it should be noted that the accuracy of the actual measures as computed by institutional officials will be directly related to the quality of the data they collect, the use of standardized procedures, and perhaps, the development of institutional policies that define these data collection activities. To some degree, these performance measures might be best seen as estimates of the extensiveness, efficiency, effectiveness, or impact of a service or activity rather than a precise measure of that particular service or activity. Even if these measures are best seen as estimates, such estimates are a significant improvement over the very limited set of performance measures that are currently available and being used.

The performance measures are organized in the manual by key areas of assessment. And within each area the following measures are currently being developed.

- **Users**: the number and types of users and the frequency with which they use the campus network
  - Count of Network Users
    by type of user
  - Count of Active Network Users
    by type of user
- **Costs**: the total and types of financial resources that are expended to operate the academic network
  - Annual Information Technology Expenditures
  - Information Technology expenditures per capita
- **Network traffic**: the amount and types of traffic flowing over the academic network
  - Router Traffic as a Measure of Overall Campus Network Activity
  - Modem Traffic into the Campus Network
  - Internet Traffic (into and out of the campus)
- **Use**: the amount and types of uses made of the network
  - Frequency of Network Use
    Percentage of Very Active Network Users
    Percentage of Inactive Network Users
- **Services**: the applications and services that are made available over the network
  - Online Public Access Catalog Measures
    Number of users using the online library catalog
    Number of campus logins to the online library catalog
    Number of off-campus logins to the online library catalog
    Number of logins to the online library catalog per user
    Cost per user to access the online library catalog
    User satisfaction with the networked online library catalog
  - Distance Learning
    Number of faculty offering distance learning courses
    Number of student enrolled in distance learning classes as a percentage of all classes offered
    Distance learning courses as a percentage of all courses offered
    Cost per distance learning course
    Technology involved in distance learning
    Student satisfaction with distance learning
- **Support**: the types of assistance that network officials make available to the users of the network
  - Help Desk
    Response Time
    Accuracy of Response
    Courtesy of Staff

Additional measures are also under consideration for inclusion in the manual. Space does not permit a detailed description of these proposed measures, how they have been operationalized, and procedures for data collection and analysis. The draft performance measures manual contains such information.

In developing these measures the study team found that oftentimes the academic institution would first have to deal with and resolve a range of issues *before* the performance measures could be computed. For example, the measures 'count of network users' (CNU), ie. the number of identified email accounts with access to the campus network, and 'count of active network users' (CANU), ie. the

number of email accounts that have logged onto the network during a one-month period, cannot be computed until the following issues are resolved:

- Defining 'the network'. For purposes of these counts we recommend that the campus network be defined as those telecommunications services and resources over which the academic institution has primary responsibility and control.
- Defining users. There may be more accurate means to identify network users than email accounts, depending on the record-keeping techniques used at a particular institution, eg. user IDs, official registrations, or payroll records.
- Including distributed computing accounts. For many institutions there are multiple servers with their own administration and email accounts. Thus, a decision must be made whether to include only centrally administered email accounts or to include email accounts from distributed servers in the CNU and CANU.
- Purging inactive accounts. The accuracy of the CNU will depend on the institution's policy regarding purging inactive accounts. Policies should be in place that regularly purge accounts from the files for those who are no longer legal institutional members.
- Defining users in the campus networking community. There may be significant numbers of individuals with email accounts on the campus system who are 'guests' and do not belong to the campus community but use the network, eg. students who graduate but continue using the network for mail and other applications. Decisions must be made to consistently count the 'bona fide' members of the campus networking community.

  Further, it may be unclear how to determine who is 'faculty' or 'students' or 'staff' or other 'types' of users. Definitions for such user types may need to be agreed upon if CNU and CANU are to be broken down by type of user.
- Defining what constitutes an 'active user'. For purposes of CANU we have recommended that an active user is one who has shown any network activity on his/her email account in a preceding one-month period. Some institutions may wish to use a different time period to define 'active user'.
- Multiple email accounts. Some individuals on campuses with multiple servers may have multiple email accounts. Thus, the number of email accounts is not the same as the number of individuals with email accounts. The level of analysis for 'email accounts' is different from 'individuals with email accounts.' For the CNU and CANU some institutions might wish to sample users to determine the average percentage who have multiple accounts to estimate the number of individuals with email accounts as opposed to the number of email accounts.

Until such issues are resolved *campus-wide*, it would be impossible to produce an accurate count of network users and active network users.

For each of the performance measures, the manual provides an operationalized definition, issues that may have to be resolved prior to obtaining data to produce the measure, data collection procedures, and suggestions for developing related measures. The actual measures to be included in the final version of the manual may change from those identified above depending on field testing of the manual during the Fall, 1995.

Next Steps

This project is scheduled for completion in December, 1995. At that time the authors will submit a final report to the funding agency summarizing project activities. The study team also will produce a performance measures manual for public distribution. The manual will have the following sections:

- Introduction to using the manual
- Quantitative performance measures
- Example network user survey
- Guidelines for collecting, organizing, and reporting anecdotal and other qualitative assessments.

The manual is a beginning effort to provide standardized guidelines to assist academic institutions to assess their academic networked environment. It has the following objectives:

- Describe a core set of performance measures that assess the academic networked environment
- Provide procedures for collecting and analyzing the data needed to produce these performance measures.
- Identify and discuss issues and problems related to data collection needed for computing these performance measures.
- Encourage academic institutions to engage in a regular program of ongoing evaluation and assessment of their computing networks.

The manual can assist network managers and higher education decision-makers to improve the usefulness and quality of their networks and better meet the needs of network users. The manual is currently in draft and is constantly being revised and expanded in response to ongoing data collection activities.

During the Fall of 1995 the study team will continue an iterative process of revising the manual, field-testing it at appropriate academic sites and with knowledgeable individuals, and then revising/editing the manual. A final assessment and review of the manual will take place at the Fall, 1995 meeting of the Coalition for Networked Information, to be held in Portland, Oregon, USA, October, 1995. Based on this assessment the study team will produce a final version of the manual for release in early 1996.

Importance of the Project

The numerous initiatives associated with developing the National Information Infrastructure in the USA (eg. National Information Infrastructure Advisory Council, 1995) and throughout the world with the evolving Global Information Infrastructure, have thrust electronic networked computing into a new arena and into a new teaching, learning, and research environment. The uses and applications of networking and the Internet continue to grow rapidly, roles and responsibilities of key stakeholders in the networked environment become increasingly blurred, a range of policy issues (eg. acceptable use, intellectual property rights, and equitable access) and questions regarding the effectiveness, efficiency, and impact of the network in academic institutions continue to be poorly defined and addressed (Heterick, 1994).

To a large extent, proponents for enhancing the academic networked environment have said, 'trust me, trust me . . . , access to and use of electronic networks improves the quality of education here at our institution.' But the reality is that evidence to support such assertions is either non-existent or anecdotal. In times of budget cuts and institutional retrenchment (such as we are seeing today), faculty, librarians, administrators, and academic computing service providers find it increasingly difficult to justify expenses for purchasing network technology, supporting network services, developing training, or demonstrating that such networks really have some impact on the educational imperatives of the institution.

Based on a number of research projects on the development of networked services and digital libraries in academic settings, Covi and Kling (1995, p.5) conclude:

> 'Our early observations suggest that universities appear to be steadily drifting into more intensive digital investments with little managerial oversight about the extent to which their investments are effective or efficient, adequate or frugal.'

Given the size and extent of such investments, and the widespread financial difficulties many institutions of higher education are experiencing, such a conclusion is most troubling. Until we have a better conceptual framework describing the 'academic networked environment' and performance measures to assess interactions and services within this environment, we will only guess at what seems to work well and why. We will only be able to guess at which strategies have had the greatest impact, for example, on learning. And, we will only be able to guess at how best to design better networked services in the future.

Notes

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Appendix A

5/15/95

Announcing A New CNI Electronic Discussion Group: IMPACTS@CNI.ORG

IMPACTS is a public, moderated computer forum that will discuss the effects of networked information technologies and services on academic institutions and the measurement of those effects. The IMPACTS forum provides the opportunity for researchers, academic administrators, academic computing personnel, network specialists, faculty, students, academic staff, and others to exchange views and information related to this topic. IMPACTS will inform the research project Developing Performance Measures to Assess the Impacts of Internet Networking on the Academic Institution, funded by the U.S. Department of Education. Objectives for the discussion forum are to:

- Provide a forum to discuss applications and issues in the use of performance measures for assessing academic networking
- Obtain input from interested individuals about the project and various project documents and position papers
- Share information on related projects or other institutional efforts to develop and use performance measures to assess academic networking.

IMPACTS May Include Topics Such As

- What information technologies and services comprise networked information, and to what degree are these similar across various academic institutions?
- Who are the "users" of networked information within the academic setting and how might we develop a typology of such users?
- What are the organizational structures used in academic institutions to provide networked information services?
- What are the key factors that appear to affect the overall success of the networked environment in an academic setting?
- What measures can be developed to assess the impacts of the networked information services and resources on the academic environment?

To SUBSCRIBE to the IMPACTS Forum

To subscribe to IMPACTS, send the following email message to LISTPROC@CNI.ORG: subscribe IMPACTS <your first name> <your last name>

To SEND MAIL to the IMPACTS Forum or Obtain Additional Information

To participate in the list discussion, please send your mail to: IMPACTS@CNI.ORG. The IMPACTS list moderator is Kristen Eschenfelder <kreschen@mailbox.syr.edu> who should be contacted for matters regarding the list. For additional information about the project contact the Co-principal Investigators: Dr. Cynthia L. Lopata (cllopata@mailbox.syr.edu) or Dr. Charles R. McClure (cmcclure@mailbox.syr.edu), School of Information Studies, Syracuse University, Syracuse, NY 13244 (315-443-2911).

Discussion

John Sumsion, Library & Information Statistics Unit (LISU): Two things you have not mentioned: one is the possibility of counting the amount of information provided through the Internet by the information providers who charge for it. The other is a kind of citation analysis. Is there any future in asking people in their research papers to indicate whether they have acquired the information through the Internet as opposed to printed sources.

Charles McClure: To answer you second point first: already I see that happening. I am the founder of the journal *Internet research* in which we regularly cite electronic sources. There are a number of manuals that give the correct style on citation of electronic information. Citation counts would be very good idea for finding out where information is coming from.

Your first question on tracking the amount of information coming from providers that sell it is really tough. We keep coming back to privacy issues. You do not know whether the bits coming through are fee-based or free-based. Unless we could get providers somehow to mark it, which in my experience is not very pleasant, I am not sure what to do about that.

Karin De Jager, University of Cape Town: I am interested in your giving readings for students online. Have you considered copyright issues?

Charles McClure: Yes I certainly have. A lot of the material I use is by people I already know and can call up on the phone for permission to use, without going through their publisher. Ultimately, I have found it to be no more difficult to put a reading up electronically and scan it than it is to put it in a reader. Those of you in library land should begin worrying about people like me in the faculty who will say: handle this problem for me. Frankly, my library doesn't handle it so my graduate student does it.

In terms of pushing copyright limits, in terms of educational uses and so on, if you put yourself on the other side, it is really not pleasant to see a full chapter of one of your books posted electronically out on a Web site, for example, which has a copyright on it. I am on a discussion net called Compriv - Commercialisation and Privatisation of the Internet - and was recently reading a discussion when I realised I was reading my own material. Someone had downloaded a report, changed a couple of things, put their name on it and sent it up. We in academic land understand this notion of intellectual property. Go down to the town and they don't have a clue what that means. Those issues of copyright and intellectual property rights are brutal. They are not going to go away. They are going to take some serious work. I don't have the answers.

Michael Carmel, S.W. Thames Regional Library Service: It seems your talk has been in two parts. You started with money problems and the difficulty of justification, you then went on to performance measures. In between you said the networked environment is going to happen.

Charles McClure: What is going to happen is more and more people using the Net without us being able to say how they are using it or why.

Michael Carmel: So if it is going to happen, why do we need to measure it in order to justify it.

Charles McClure: Great question. Here's why. Think about what's going to happen when 2000 freshmen get on your campus tomorrow and they all want to get connected to a Web server. Do you have the bandwidth to do that?

Michael Carmel: I am not on an academic campus.

Charles McClure: But you understand what I am saying. If more and more people are getting on, we don't know what kinds of network services to pro-

vide. We don't know how to plan for them. For purposes of planning services to meet user needs, we have to know what is going on. What's being used and how well they use it. Our campus-wide information system, for example: I turn on my computer and get this menu - and I am constantly reassured by computing that this is a user-friendly manual. It's not. Until they understand what constitutes user friendly, through evaluation and ongoing assessment, we will continue to get non-user-friendly user-friendly interfaces.

Don Revill, Liverpool John Moores University: What do you think about demand reduction strategies? Our computing people see the network as its own justification. They see us as trying to control it, codify it, classify it, just like librarians. Also, my senior managers don't understand computers. My Vice Chancellor gets his secretary to see to his email. They see it as heap powerful ju-ju. Have you any comments on that?

Charles McClure: I understand demand reduction strategies. You really don't want ten million people waiting in queue at the help-desk. What I proposed at one of the universities, was for them to do more training, which would reduce the number of questions. When you do that, you increase people's knowledge to where they're dangerous. They want to know more. The notion of demand reduction strategy is an interesting one. It's problematic.

Second comment: it is a very real problem that the people who demand justification and performance measures are exactly the ones who don't know anything about the Net. They never use it. Their secretaries use it. Increasingly we have to say to people: excuse me, you don't know how to read email, watch me. I will train you. I will help you. That is something the library community can do. Training and education are critical and are something the library community could do well. We could really carve out a niche for ourselves in this networked environment. But again, that is just one more little leaf on top of the salad. We are anally retentive, compulsive, type A people. One of the things performance measurement is supposed to do, is to help you prioritise. I don't think it has done that. We have widened our playing cards even more. We have got to set priorities.